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AUTHOR Everson, Howard T.; And Others
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ABSTRACT

Prior research suggests that the traditionally difficult academic subject matter, such as mathematics or the natural sciences, may evoke greater levels of evaluative (test) anxiety than curricular areas with easier content. These higher levels of anxiety may contribute to poor performance in mathematics and science courses. College freshmen's self-reported test anxieties were explored in four traditional academic curricular areas: (1) English; (2) mathematics; (3) science; and (4) social studies. It was hypothesized that students would report greater anxiety when they thought that mastery of a subject required precise answers rather than a general understanding of the subject matter. A total of 214 students (139 males and 75 females) attending a pre-freshman summer program at a major urban university were randomly assigned to groups in a 4 x 3 factorial design of subject matter by demand instructions. The Worry-Emotionality Scale was adapted to elicit students' anxiety concerning future college examinations in the four academic subjects. A five-item Likert-type scale was developed to determine students' perceptions about the difficulty of the academic subjects. Analysis of covariance results show that science elicited the highest levels of self-reported evaluative anxiety, after controlling for perceptions of subject matter difficulty. The effects for demand instructions were not significant. The implications of the results for both the role of test anxiety in science courses and the importance of subject matter in test anxiety research are considered. Three tables are included; the two scales are appended. (SLD)

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# Test Anxiety in Different Curricular Areas: An Exploratory Analysis of the Role of Subject Matter

Howard T. Everson
City University of New York

Sigmund Tobias and Hope Hartman
City College of New York
City University of New York

Annette Gourgey
City University of New York

Paper presented at the annual meeting of the American Educational Research Association, Chicago, IL, April, 1991. Correspondence concerning this paper should be sent to Dr. H.T. Everson, Office of Academic Affairs, City University of New York, 535 E. 80th St., NYC NY 10021.

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## Abstract

Prior research suggests that traditionally difficult academic subject matter, such as that found in mathematics and the natural sciences, may evoke greater levels of evaluative (test) anxiety than other curricular areas with easier content. These higher levels of anxiety, in turn, may contribute to poor performance in math and science courses. The purpose of this research was to explore freshmen college students' self-reported test anxiety in four traditional academic curricular areas: English, Mathematics, Science, and Social Studies. We hypothesized that students would report greater anxiety when they thought mastery of a curricular area required precise answers rather than a general understanding of the subject matter. A total of 214 participants were assigned randomly to groups in a 4 x 3 factorial design--subject matter (4) by demand instructions (3). ANCOVA results indicate Science elicited the highest levels of self-reported evaluative anxiety, after controlling for perceptions of subject matter difficulty. Effects for demand instructions were not significant. Results are discussed in terms of their implications for both the role of test anxiety in science courses and the importance of subject matter in test anxiety research.

## Introduction

There are many different constructs relating anxiety to learning from instruction. These include test anxiety, or students' fears about evaluations of their learning, as well as more specific concerns about learning and being assessed in traditional academic subjects such as mathematics, science, public speaking, and writing (Dew, Galassi & Galassi, 1983; Hill, 1986; Mallow, 1982). Indeed, research has made it abundantly clear that test anxiety is a significant educational problem for all levels of students--elementary, secondary, and postsecondary (Hill, 1984; Wigfield and Eccles, 1989). More than thirty years of research documents that highly test-anxious students do not perform as well as their less anxious counterparts (Benjamin, McKeachie, Lin, & Holinger, 1981; McKeachie, 1984; McKeachie, Pollie, & Spiesman, 1955; Sarason, 1980; Sieber, O'Neil, & Tobias, 1977). Hembree (1988) conducted an extensive meta-analysis of 562 studies dealing with anxiety. His analysis indicated that test anxiety played a significant role in students' learning from instruction. Moreover, it is often the case that highly anxious students are also weak academically, exhibiting inefficient study habits and difficulty organizing instructional material (Naveh-Benjamin, McKeachie, & Lin, 1987; Culler & Holahan, 1980; Everson, Millsap, & Browne, 1989)

Prior research has determined that difficult subject matter evokes greater anxiety than curricular areas judged by students as easier. Hembree (1988) also reported that students' perceptions of the difficulty of various curricular areas were meaningfully related to their anxiety about those subjects. It has been suggested recently (Tobias, in press) that studies comparing students' anxiety about different content areas would clarify the assumption -- albeit derived from anecdotal evidence--that students are generally more anxious about technical subjects such as mathematics and science than they are about humanities or social sciences. If as Naveh-Benjamin, et al. (1987) and others have suggested, highly anxious students are poor organizers of course concepts and, further, if academic subjects are viewed by students as more or less complex, then it is not unlikely that students' levels of evaluative anxiety may be linked to subject matter domains. Thus, a primary purpose of this research was to compare students' self-reported evaluative anxiety in four traditional academic curricular areas: English, Mathematics, Science, and Social Studies.

Research has also demonstrated that anxiety interferes most with performance when the cognitive capacity required by a task and coupled with the central representation of anxiety strains available intellectual resources (Paulman & Kennely, 1984; Tobias, 1985). Moreover, studies have found that anxiety effects were strongest in situations that posed a clear evaluative threat to students. Recent debate about the high risk nature of courses in

science and mathematics suggests that the nature of these subjects and the ways in which they have been traditionally taught--large lectures, high reliance on technical readings, and remote instructors-- may, indeed, threaten students. Hence, a further purpose of this research was to investigate experimentally whether student attitudes about the demands made by different curricular areas--particularly the perception of the degree of accuracy and precion required for mastery of the subject matter--contribute to their anxiety about tests in those areas. Thus, we expected test anxiety to be a function of students' perceptions of the degree to the various curricular domains required accuracy and precision of knowledge on tests.

In sum, we reasoned that if students believed mastery of a subject, like mathematics or science, required accurate knowledge of specific rules and precise answers, then it also seemed likely that they would feel that lack of competence would be relatively easy to detect by tests in these fields. In turn, such fields should be seen by students as posing a greater evaluative threat, leading to increased anxiety in academic domains demanding accuracy and precision. Therefore, we hypothesized that students would report greater anxiety when they believed a particular field required precise and accurate answers than when they thought a more general understanding was required.

## Method

### Participants

A total of 214 students (139 males and 75 females), participated in the study. The sample was ethnically diverse and had average age of 21 years old. Participants were attending a pre-freshman summer program at a major urban university to improve their basic skills in reading comprehension, mathematics, and writing prior to beginning their first semester in college.

### Procedure

Participants were randomly assigned to treatment groups in a 4 x 3 factorial design. The first factor was defined by asking students to rate their anxiety, using a revision of the Worry- Emotionality scale (Morris, Davis, & Hutchings, 1981), in one of four traditional academic curricular areas: English, Mathematics, Science, or Social Studies. Participants also completed a short scale describing their opinions regarding the difficulty of these academic subjects. The second factor consisted of randomly assigning participants to instructions describing the various curricular areas as requiring either (1) accurate and

precise answers, (2) a general understanding of the content, or (3) a control condition specifying no particular set of requirements.

Three sets of identical instructions--varying only in one aspect--were developed which described the ways college professors determined students' knowledge in the four subjects. One version stressed that professors gave tests requiring a specific correct answer and relying heavily on students' knowledge of information and rules. The second version stressed that professors looked for evidence that the content was understood and de-emphasized the need for specific correct answers. The control group's instructions simply asked participants to complete the scales the way they would feel while taking a test.

### Material

The Worry-Emotionality Scale was adapted to elicit participants' anxiety about what their feelings were likely to be in future college exams in any of the four different subjects (Alpha=.87, Cronbach, 1951). Participants' perceptions about the difficulty of the academic subjects were measured using a five item Likert-type scale developed for this study (Alpha=.55, Cronbach, 1951). Examples of both scales are found in Appendix A and B, respectively.

## Results

The participants' test anxiety (Worry- Emotionality) scores, difficult ratings, and their correlations are reported in Table 1 for each subject matter group.

**Table 1. Test Anxiety Scores and Difficulty Ratings By Subject Matter**

| | Math | | English | | Social Studies | | Science | |
|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| Test Anxiety | 21.2 | 7.7 | 20.0 | 6.4 | 18.5 | 6.9 | 22.7 | 8.2 |
| Difficulty | 12.0 | 2.4 | 11.4 | 2.2 | 11.3 | 2.7 | 11.5 | 2.3 |

The correlation between the Worry-Emotionality scores and measures of attitudes about subject matter difficulty, independent of subject matter or instructions, was .19. A 4 x 3 analysis of covariance of the test anxiety scores, controlling for the students' perception of the difficulty of the subject matter revealed a significant main effect for curricular area ($F = 7.52$, $p<.05$, see Table 2).

**Table 2. Analysis of Test Anxiety Scores: Curricular Areas By Instructions Controlling for Perception of Difficulty.**

| SOURCE OF VARIATION | SUM OF SQUARES | DF | MEAN SQUARE | F | SIGNIF OF F |
|---|---|---|---|---|---|
| **Covariate** | | | | | |
| DIFFICULTY | 378.436 | 1 | 378.436 | 7.52 | .007 |
| **Main Effects** | 552.593 | 5 | 110.519 | 2.20 | .057 |
| INSTRUCTIONS | 92.038 | 2 | 46.019 | 0.91 | .403 |
| SUBJECT MATTER | 437.929 | 3 | 145.976 | 2.90 | .036 |
| **2-Way Interaction** | | | | | |
| INSTRUCTIONS x AREA | 323.011 | 6 | 53.835 | 1.07 | .382 |
| EXPLAINED | 254.040 | 12 | 104.503 | 2.08 | .020 |
| RESIDUAL | 9209.485 | 183 | 50.325 | | |
| **Total** | 10463.526 | 195 | 53.659 | | |

The results of the analysis of covariance suggest that participants were differentially more anxious about examinations and evaluations in some curricular areas, even after controlling for the influence of their perceptions of difficulty in those subjects. There were no differences attributable to the instructions and no interactions were significant.

Analysis of differences among the cell means, using post hoc tests (Scheffe, 1953) indicates that Science elicited the highest test anxiety reports. The adjusted cell means and number of participants per cell are presented in Table 3.

**Table 3 . Adjusted Test Anxiety Means and N's by Subject Matter and Experimental Instructions.**

| GRAND MEAN |
|---|
| 20.41 |
| (196) |

| INSTRUCTIONS | | |
|---|---|---|
| Accuracy | Understanding | Control |
| 19.55 | 22.20 | 20.04 |
| (69) | (70) | (57) |

| SUBJECT MATTER | | | |
|---|---|---|---|
| Mathematics | English | Social Studies | Science |
| 21.05 | 20.17 | 16.51 | 25.22 |
| (50) | (50) | (53) | (43) |

In view of the large research literature dealing with math anxiety (Hill, 1986), it was surprising to find that Science evoked significantly greater anxiety than Mathematics, English, or Social Studies.

## Conclusion

The research reported in this paper may advance our understanding of the effects of test anxiety on learning and instruction by highlighting the comparative influences of both the subject matter itself, and students' perception of the relative difficulty of exams in different content areas. Prior research on test anxiety has neglected these issues. Our analyses, for example, suggest that students' perceptions of a subject's difficulty, as well as the evaluative demands of particular pedagogical techniques--disciplined-based or otherwise--contribute to students' levels of test anxiety.

This study is another step toward a comprehensive and differential approach to understanding test-anxious students. In the recent past we made strides in our understanding of the types of test-anxious students (Benjamin et al., 1981; Tobias, 1985) and we have developed methods for ameliorating the effects of test anxiety (Naveh-Benjamin, 1991). These methods may be refined further by taking into account students' perceptions of the complexity and demands of various academic subjects and curricular domains. Programs designed specifically to address not only the information processing deficits of test-anxious students, but also their attitudes, beliefs, and perceptions about various curricular areas--like science and mathematics--may help reduce anxiety and enhance academic achievement in these curricular areas. Further research should reveal ithe extent to which these attitudes are malleable.

This line of research holds promise for enlightening the teaching faculty in science and technology intensive disciplines. Clearly, students' thoughts and feelings about being evaluated in these courses may be modified to some extent by behaviors and attitudes of the teaching faculty. Starting from the premise that we need to teach more students more science, introductory science courses can no longer remain intimidating and highly selective. Faculty involved in teaching these courses need to understand the role of evaluative anxiety plays in terms of student achievement and find ways to diminish its negative effects.

## REFERENCES

Benjamin, M., McKeachie, W.J., Lin, Y.G., & Holinger, D. (1981). Test anxiety: Deficits in information processing. Journal of Educational Psychology, 73, 816-824.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. Psychometrika, 16, 297-334.

Culler, R.E., & Holahan, C. (1980). Test taking and academic performance: The effects of study-related behaviors. Journal of Educational Psychology, 72, 16-20.

Dew, K.M.H., Galassi, J.P. & Galassi, M.D. (1983). Mathematics anxiety: Some basic issues. Journal of Counseling Psychology, 30(3), 443-446.

Everson, H., Millsap, R., & Browne, J. (1989). Cognitive interference or skills deficit: An empirical test of two competing theories of test anxiety. Anxiety Research, 1, 313-325.

Hembree, R. (1988). Correlates, causes, effects, and treatment of test anxiety. Review of Educational Research, 58, 47-77.

Hill, K.T. (1984). Debilitating motivation and testing: A major educational problem, possible solutions, and policy applications. In R.E. Ames & C. Ames (Eds.), Research on motivation in education (Vol.1, pp.245-274). NY: Academic.

Hill, K.T. (1986, April). Math anxiety in secondary school students: America's Achilles heel in the new era of high technology? Paper presented at the annual meeting of the American Educational Research Association, San Francisco.

Mallow, J.V. (1982). Science anxiety: Causes and remedies. Journal of College Science Teaching, 11, 356-358.

McKeachie, W.J. (1984). Does anxiety disrupt information processing or does poor information processing lead to anxiety? International Review of Applied Psychology, 33, 187-203.

McKeachie, W.J., Pollie, D., & Spiesman, J. (1955). Relieving anxiety in classroom examinations. Journal of Abnormal and Social Psychology, 50, 93-98.

Morris, L.W., Davis, M.A., & Hutchings, C.H. (1981). Cognitive and emotional components of anxiety: Literature review and a revised worry-emotionality scale. Journal of Educational Psychology, 73, 541-555.

Naveh-Benjamin, M. (1991). A comparison of training programs intended for different types of test-anxious students: Further support for an information-processing model. Journal of Educational Psychology, 83 (1), 134-139.

Naveh-Benjamin, M., McKeachie, W.J., Lin, Y.G. (1987). Two types of test-anxious students: Support for an information processing model. Journal of Educational Psychology, 79, 131-136.

Paulman, R.G., & Kennelly, K.J. (1984). Test anxiety and ineffective test taking: Different names, same construct. Journal of Educational Psychology, 76, 279-288.

Scheffe, H. (1953). A method for judging all contrasts in the Analysis of Variance. Biometrika, 87-104.

Tobias, S. (in press). The impact of test anxiety on cognition and school learning. In H.M. van der Ploeg, R. Schwarzer & C.D. Speilberger (Eds.), Advances in Test Anxiety Research, (Vol. 8).

Tobias, S. (1985). Test anxiety: Cognitive interference, defective skills, and cognitive capacity. Educational Psychologist, 2 (3), 135-142.

Wigfield, A. & Eccles, J.S. (1989). Test anxiety in elementary and secondary school students. Educational Psychologist, 24(2), 159-183.

## APPENDIX A

### Perception of Difficulty (Attitude) Scale

1. Thinking of all school subjects, how much time did you spend studying and doing homework in (curricular area).
   Most time of all  Lot of time  Not much time  Least time of all

2. How did you feel about (curricular area) in comparison to other subjects?
   Liked it a lot  Liked it a little  Disliked it a little  Disliked it a lot

3. Would you choose to take a course in (curricular area) if you did not have to?
   Very likely  Probably  Unlikely  Very unlikely

4. Compared to other subjects, how difficult do you feel (curricular area) is?
   Very difficult  Fairly difficult  Fairly easy  Very easy

5. How likely are you to choose (curricular area) as you major in college?
   Very likely  Probably  Unlikely  Very unlikely

## APPENDIX B

### Worry-Emotionality Questionnaire (Adapted)

When answering the questions below, imagine you are take a test in (curricular area). To the left of each statement indicate what your feelings, attitudes, or thoughts would be if you were taking a test in (curricular area). Use the following scale to answer the questions:

1 = I would not feel that way at all.
2 = I would feel that way a little.
3 = I would feel that way to a medium degree.
4 = I would feel that way strongly.
5 = I would feel that way very strongly.

_____I would feel my heart beating fast.

_____I would feel regretful.

_____I would feel tense and my stomach would be upset.

_____I would feel that I should have studied more for that test.

_____I would feel uneasy and upset.

_____I would feel that others would be disappointed in me.

_____I would feel nervous.

_____I would feel that I may not do as well on that test as I could have.

_____I would feel panicky.

_____I would not feel very confident about my performance on that test.